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BIOLOGICAL EVALUATION OF PEST CONDITIONS AND
POTENTIAL HAZARD TREES IN SELECTED RECREATION SITES
ON THE SMOKEY BEAR RANGER DISTRICT,
LINCOLN NATIONAL FOREST, NEW MEXICO

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MAY 1990

By

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ABSTRACT

In 1989, Forest Pest Management in Region 3 initiated an Insect and Disease Incidence Survey Program of recreation sites. The purpose of this program is to evaluate the overall "health" of proposed and existing recreation areas on the National Forests in the Southwest. At the request of Sam Tobias, Recreation and Lands Staff, Smokey Bear Ranger District (RD), Lincoln National Forest, surveys were conducted at the Cedar Creek and South Fork Campgrounds (CG). This report summarizes the hazardous trees and the insect and disease pest conditions found during these surveys. The Cedar Creek CG site is a new development consisting of three small group campsites scheduled to open in June 1990. South Fork CG contains 60 individual campsites and is scheduled for rehabilitation sometime in 1990. The information provided in this report offers pest management considerations that can be used to develop vegetation management plans.

OBJECTIVES

The objectives of this survey were to: (1) Identify hazardous trees occurring within these developed recreation sites, and (2) evaluate the incidence of insect and disease pest activity and damages in recreation sites scheduled for reconstruction.

SURVEY DESIGN

The procedures followed are described in the "Inventory of Insects, Disease, and Hazard Tree Incidence Work Plan for Developed Recreation Sites on National Forest System Lands in the Southwest" (Rogers, 1989). This survey consists of two parts; a hazard tree survey and an insect and disease pest incidence survey. A hazard tree is defined as any tree with both a structural defect that could cause the tree to fail and a potential target (ex., table, campsite, parking pad, toilet facility, etc.) Only trees located in areas of intensive public use and showing signs of structural defect (dead top and/or branches, bole rot, and exposed roots, etc.) were evaluated. Tree species, diameter inside bark (DIB), location, defect, and hazard tree rating were recorded on the Hazard Tree Evaluation Forms (Appendix) and plotted on the site design maps provided by the Forest (Appendix).

The hazard tree rating system is patterned on the procedures described by Johnson (1981) and involves the factors that contribute to tree failure such as dead limbs and weak forks, degree of lean and signs of insect and disease-caused damages. This system involves a two-part Failure/Risk rating, each part using a descriptive rating scale of High (H), Medium (M), and Low (L) to estimate probability. The first part of this rating system is an estimate of the probability that the tree, or major portions thereof, will fail within the next five years; the second part is an estimate of the probability that the failed tree, or portions thereof, will cause injury to people or damage to property if failure does occur. Only trees located in areas more likely to be occupied by people or property were evaluated and recorded on the evaluation forms.

The insect and disease pest incidence survey was a 100 percent tree survey

conducted concurrently with the hazard tree evaluation survey. The following data were collected for each tree exhibiting signs of insect, disease, and abiotic damages: Species, diameter at breast height (DBH), tree history, damage code, and a dwarf mistletoe rating (DMR) (Hawksworth, 1977). These data were recorded on Region 3's Forest Stand Tree Record Sheets.

RESULTS AND DISCUSSION

Sites surveyed are composed of a ponderosa pine overstory mixed with a few scattered Southwestern white pine, Douglas-fir, and white fir. Understory seedling and saplings consisted almost entirely of ponderosa pine at the Cedar Creek CG site and primarily mixed conifers (southwestern white pine, Douglas-fir, and white fir) at the South Fork CG site. Fourteen trees were rated for hazard at the South Fork CG site. Fourteen of the trees rated were the result of recent mortality caused by the western pine beetle (WPB), Dendroctonus brevicomis (Figure 1, Appendix). Half of these WPB-killed trees (seven trees) were rated in the "high failure/high risk" category (H/H), which means they have a high probability of failing within the next five years. All of these category 1 trees (H/H) are also located near or adjacent to permanent structures (buildings, tables, etc.) and/or areas of public access. The number of hazard trees in each rating category or class are summarized in Table 1 below. Specific information on the recorded hazard trees and their exact locations are provided on the Tree Hazard Evaluation Forms (Appendix).

Table 1. Summary of hazard trees by rating class for each recreation site surveyed. Smokey Bear Ranger District, Lincoln National Forest.

	Number of Trees with Rating of:		
Campground	H/H[a]	H/L	Total
Cedar Creek CG	0	0	0
South Fork CG	7	7	14

CG = Campground

[a] Failure/ Risk Rating: H = high; M = Medium; L = Low

The hazard tree ratings provided are not recommendations for action. They are a professional estimate of the probability of tree failure and should be used by the land manager during the decision-making process when developing management plans for recreation areas. Highest priority should be given to category 1 trees (H/H), since they are the most prone to failure within the next five years and present the greatest risk to property and public safety.

The most damaging pest observed during this survey was southwestern dwarf mistletoe (SWDM), Arceuthobium vaginatum subspecies cryptopodum. This plant parasite is widespread throughout the ponderosa pine stands including the Cedar Creek CG and South Fork CG sites (Figures 1 & 2, Appendix). Individual tree dwarf mistletoe ratings (DMRs) in these campgrounds ranged from 2-6 and averaged 4 (Hawksworth 6-Class Rating System, 1977). The heaviest tree infections (DMR 6) were observed at the Cedar Creek CG site in the foreground retention area located between Group Camp Units 1 and 2 along Cedar Creek and

Forest Road 88 (Figure 1, Appendix). The majority of the ponderosa pines growing near and adjacent to Group Camp Units 2 and 3 and the islands between the roads leading to them were also heavily infected with SWDM (DMRs 4 & 5).

There are six possible ratings for dwarf mistletoe (DM) infected trees (1-6), and one for noninfected trees (0). Infection classes 1, 2, and 3 usually result in little or no impact on pole and sawtimber-sized trees. Trees with 4, 5, and 6 class infections and large witches brooms are declining in growth and vigor and are poor risk trees. Seedlings and saplings can be severely affected even when in DMR classes as low as 1, 2, and 3 (Beatty, 1982).

Generally, SWDM infection levels increase one mistletoe rating class every ten years. Mortality rates are much higher for trees in infection classes 4, 5, and 6, especially if these trees are showing signs of heavy brooming. Broomed branches are usually not naturally pruned by the tree and represent a nutrient sink that seriously reduces the vigor of the host. Trees pruned of large witches' brooms often show dramatic increases in tree vigor and life span.

Other insect and disease-related damages (other than hazard trees) found at the South Fork CG included those caused by the western spruce budworm (WSB), Choristoneura occidentalis; western pine beetle (WPB), Dendroctonus brevicomis; and armillaria root disease, Amillaria spp. Larvae of the WSB, which were at outbreak levels from 1983 to 1988, caused extensive defoliation (needle loss) to Douglas-fir, true firs, and spruce. Defoliation damages were heaviest in the mixed conifer stands located near the entrance gate of the campground, just east of Forest Service access road no. 8107-C, (Figure 1, Appendix) and in the surrounding mixed conifer stands along the campground perimeter. The results of our 1989 aerial survey (see 3410 letter dated July 19, 1989) and this survey indicate the budworm has declined to undetectable levels.

Tree mortality resulting from recent WPB activity was widely scattered throughout the South Fork CG (Figure 1, Appendix). A total of 24 trees were killed by this bark beetle in 1989. Mortality occurred both singly and in small groups ranging from two to six trees. As previously mentioned, seven of the WPB-killed standing dead trees were rated as high risk hazard trees because of their proximity to permanent structures and areas of public access.

Armillaria root disease was found affecting Douglas-fir saplings and sawtimber sized trees along the north side of the east loop of South Fork CG (Figure 1, Appendix). An examination of a dead sapling revealed the symptomatic mycelial fans characteristic of this disease. In addition to the dead sapling examined, four mature Douglas-fir trees were found exhibiting symptoms of advanced root disease infections: Yellowish discolored crowns with thin foliage, branch dieback, and reduced shoot and foliar growth (Williams et al., 1986).

BIOLOGY OF PESTS

Southwestern Dwarf Mistletoe, Arceuthobium vaginatum subspecies cryptopodum

Southwestern dwarf mistletoe (SWDM) is the most damaging disease of ponderosa pine, Pinus ponderosa var scopulorum (Hawksworth, 1961). Dwarf mistletoes are parasitic, seed-bearing plants that depend on their hosts almost completely for water and nutrients. The disease spreads by explosively released seeds which

are expelled to distances ranging from 10 to 40 feet. Seeds of SWDM are released in late July and early August. Infection follows a few months after dispersal, most taking place through the bark on needle-bearing portions of twigs. Dwarf mistletoes first produce an endophytic system, a specialized root-like structure that is in contact with the phloem and xylem of host trees, from which the parasite obtains most of its nutrients and water. The aerial shoots appear between two to five years after infection; this period of infection before shoots are visible is known as the latent period.

The disease causes a decrease in the quality, quantity, and germination percent of seeds produced, lowers timber quality, reduces growth, and eventually leads to mortality in heavily infected trees. Severely infected trees are more susceptible to attacks by insects and other diseases and to environmental stresses such as drought. Heavily infected trees (DMR = 5 or 6) may sustain a 20 to 50 percent reduction in growth when compared to uninfected trees and their life expectancy is severely decreased (Lightle and Hawksworth, 1973). Dwarf mistletoe infects trees of all ages, thus, it is a problem in second growth and regeneration, as well as mature and overmature stands.

Spread of SWDM is a function of stand density, age, and site index, and averages one to two feet a year. Spread is most efficient and rapid from an infected overstory to an understory and slowest through an evenaged stand. Management of SWDM is directed toward decreasing spread and intensification of disease since DM eradication is achieved only by removing the entire stand of trees.

The following suggestions for SWDM control in recreational forests are offered based on a 20 year study in Grand Canyon NP by Lightle and Hawksworth (1973):

-Pruning is recommended in lightly infected trees (DMR <3). Remove branches two whorls above highest DM-infected branch to insure against latent infections. No more than 50% of the live crown should be removed.

-Confine pruning to more isolated trees. Repruning has been required in densely stocked stands due to numerous latent infection in areas initially considered lightly infected.

-Infected branches should be cut off at the bole in order to insure removal of the endophytic, root-like, system in the host tissue.

-Trees with bole infections do not need to be killed since bole infections are not vigorous.

-Pruning witches brooms on heavily infected trees (DMR = 3-4) does prolong life. A shorter life expectancy corresponds to higher DMR.

Other management strategies include:

-Sanitize densely stocked stands. The most severely infected trees are removed to eliminate much of the inoculum and promote vigor of lightly and noninfected trees.

-Remove severely infected overstory trees. A vegetation management plan is desirable, with emphasis on nonhost species eventually replacing DM-infected trees.

-Apply ethylene-releasing chemicals to promote abscission of DM aerial shoots (Beatty, et. al., 1988; Nicholls, et. al., 1987). This method greatly reduces seed dispersal; the pathogen is not eliminated since the endophytic system remains viable within the host tissue and new aerial shoots form in two to five years. Chemicals need to be reapplied every few years, making this method suitable to high value areas where susceptible trees have been established under an infected overstory.

Western Spruce Budworm, Choristonerua occidentalis

The western spruce budworm (WSB) is a native insect occurring throughout the Douglas-fir, true fir, and mixed conifer forest cover types in the western United States. When at outbreak levels, the budworm is capable of causing considerable damages to commercially forested areas, developed recreation sites, and areas valued for their esthetic and scenic beauty.

Despite its name, the WSB feeds on and damages a variety of coniferous trees. Douglas-fir, true firs, and spruce are the primary host species in New Mexico. Budworm larvae, particularly in the mature stages feed almost exclusively on the new foliage of host trees. During periods of epidemic population levels, these feeding larvae may consume nearly all the new needle growth, causing the tree crowns to appear scorched as if burned by fire. Several years of intensive feeding may result in trees being completely defoliated and appearing dead. Severe defoliation impacts the visual quality of the areas and causes growth loss, top-killing, tree mortality, and predisposes the highly stressed trees to bark beetle attack.

The budworm has one generation a year. Moth flight and mating generally occurs in late July through early August. Females then lay eggs on the undersides of needles from late July through mid-August. Eggs hatch in about ten days. The hatching caterpillars do not feed, but seek hiding places on limbs or the bole of host trees. They spin silken shelters (hibernacula) in which they hibernate during the winter. In the spring, the larvae begin mining the reproductive and vegetative buds and older needles. Later they begin feeding on the new foliage. Larvae mature in 30 to 40 days after attacking the buds. The mature larvae pupate in silken webs at the last feeding site or elsewhere on the foliage. The pupal stage lasts about ten days after which the adult moth emerges.

Budworm populations are usually regulated by combinations of several natural factors such as insect parasites, vertebrate and invertebrate predators, and adverse weather conditions. However, the combined effect of natural agents does not prevent or reduce population resurgences when climatic and forest stand conditions are favorable for an increase in budworm populations. Conditions favoring budworm population buildups in the Southwest include extended periods of warm, dry weather patterns during the spring and early summer months, and management practices that promote multistoried stands with a high percentage that are composed predominantly of budworm-preferred shade tolerant species such as white fir and Douglas-fir. During prolonged outbreaks when stands become heavily defoliated, starvation can be an important mortality

factor in regulating populations.

When necessary, WSB populations can be substantially reduced with insecticides. Large forested areas can be aerially sprayed for short-term protection and individual high value trees can be sprayed using ground spray equipment. However, the preferred management approach is through long-term silvicultural programs that facilitate a succession of vegetation favoring ponderosa pine, Douglas-fir, and aspen in vigorously growing even-aged stands. These stands should be noncontiguous and evenly distributed by age class.

Western Pine Beetle, Dendroctonus brevicomis

Western pine beetles mass-attack stands of ponderosa pine, carrying and transmitting fungi which aid in killing the host. Western pine beetles produce between two and four generations per year depending on latitude and elevation. Flight and attacks start in late spring or early summer and continue until the onset of cold weather (DeMars, 1982). Western pine beetle attacks are initiated by adult females, usually at mid bole. Evidence of attack is marked by white to reddish pitch tubes on the bark. The attack process is mediated by chemical messengers or pheromones released by the beetles in combination with host terpenes. The beetles excavate winding sinuous egg galleries under the bark. Eggs are laid in niches chewed into the sides of the gallery. Once the eggs hatch, the larvae feed in short galleries perpendicular to the parent gallery. Later, larval stages feed in the middle bark. Pupation also occurs there. Brood adults first feed in the middle and outer bark before emerging. This cycle varies in length from two to ten months depending on temperature.

This insect usually breeds in scattered, slow growing overmature trees and diseased or damaged trees. Group-killing is also common in dense, overstocked stands of young sawtimber. Trees under six inches in diameter are seldom attacked. Environmental stresses which permanently weaken individual or small groups of trees (lightening strikes, root diseases, mistletoes, mechanical damage) or temporarily weakened whole stands (droughts, defoliators, fires) predispose trees to attack and create conditions for outbreaks to occur. A good example was documented in southern California where effects of ozone damage were examined. Beetle productivity was greater in ozone-damaged trees since fewer attacks were required to kill the tree. The ratio of brood emergence to attacking beetles was greater for the ozone affected trees.

There are a number of natural enemies of this insect; woodpeckers, and several parasitic and predatory insects. However, the main factor thought to influence occurrence of outbreaks is the abundance of suitable hosts. Suppression of western pine beetle populations has often been found to be expensive and unsatisfactory since timely spotting and treatment is difficult. However, sanitation-salvage logging can be applied to minimize losses. Prevention of outbreaks is the most effective way of reducing losses. Unacceptable losses can be prevented in most circumstances (barring severe drought) by maintaining thrifty, vigorous trees. Thinning dense 70-80 year old sawtimber stands, thereby reducing stocking to 55-70 percent of the basal area necessary for full site utilization, relieves competitive stress among remaining trees, making them less prone to successful attack.

Individual high value trees that are predisposed to attack by temporary stress may be given a protective residual bark spray to prevent successful attack.

Such treatment can be effective if the protection for one or two years would allow the tree to recover. It should not be considered for trees suffering from severe root disease or damage.

Armillaria root disease, Armillaria spp.

Armillaria root disease is caused by fungi which live as parasites on living host tissue or as saprophytes on dead woody material. Recent research indicates that several different, but closely related, species are involved. Therefore, the generic term Armillaria is used to refer to the group.

These fungi are natural components of forests, where they live on coarse roots and lower stems of conifers and broad-leaved trees.

As parasites, the fungi cause mortality, wood decay, and growth reduction. They infect and kill trees that have already been weakened by competition, other pests, or climatic factors. The fungi also infect healthy trees, either killing them outright or predisposing them to attack by other fungi and insects.

Because these fungi commonly occur in the roots, their detection is difficult unless characteristic mushrooms are produced around the base of the tree or symptoms become obvious in the crown or on the lower stem. Crown symptoms on conifers vary somewhat, but typically consist of thin yellowing crowns, branch die-back, and reduced shoot and foliar growth. On large, lightly infected or fairly vigorous trees, crown symptoms develop over a number of years until the tree dies. Conifers, especially Douglas-fir, frequently produce a larger-than-normal crop of cones (stress crop), shortly before they die.

On small, extensively infected trees, crown symptoms develop rapidly: The foliage quickly discolors, and the trees (seedlings and saplings) often die within a year. On such trees, foliage loss and reduced shoot and foliar growth may not be noticed until tree death.

If armillaria is present, removing the bark covering infections will expose the characteristic white mycelial fan-shaped mats or root-like rhizomorphs that grow between the wood and the bark.

Trees of different species and sizes may be killed individually throughout stands. Armillaria kills trees, primarily conifers, in a pattern of progressively expanding disease centers. Armillaria may live for decades in coarse woody material. From this food base, the fungi spread to living hosts. Spread occurs when the rhizomorphs, growing through the soil contact uninfected roots or when uninfected roots contact infected ones. When infected live trees are cut, this disease rapidly spreads into the uncolonized parts of the roots and stumps. As a result, the food source increases and may be responsible for initiating new disease centers.

Outright mortality is the most frequently observed result of infection, which can be a problem in timber stands and recreation areas. Because decay extends only a few feet into the lower stem, it is often unnoticed until the tree fails or is cut. Tree failures can pose significant hazards in recreation areas.

Because these fungi are indigenous to many areas, exclusion is not feasible; management should be directed toward limiting disease buildup or reducing its impact. Cultural management shows promise for dealing with armillaria. Many of the considerations currently being applied in commercial forests can also be implemented in recreation areas. These include: (1) Maintaining vigorous tree growth without causing undue damage to soils (avoiding compacting soils), (2) minimizing stress to and wounding of high value trees, (3) reducing the food source by uprooting infected root systems and stumps when root rot-infected trees fail or are removed when they are designated as hazardous to property and public safety, and (4) regenerating with less susceptible species.

MANAGEMENT ALTERNATIVES

1. Do nothing. Trees rated as potential hazards will continue to decline and the probability of failure will increase. Trees will continue to be damaged by campers and by natural causes, so the number of potential hazards will also increase. The possibility of tree failure with property damage and injury to people will increase. Dwarf mistletoe-infected trees will continue to decline in health and vigor and serve as inoculum for spread and intensification of the disease. Many of these trees may be predisposed to bark beetle attacks. Continued spread of armillaria in South Fork CG may lead to increased tree mortality and hazard to recreationists.

2. Remove hazard trees or lessen the probability of failure of hazard trees. This alternative would involve removing trees that have been identified as potential hazard trees. In many cases, pruning dead branches and large brooms would substantially reduce the probability of failure. The land manager must decide what level of risk is acceptable in an area; hazardous trees would then be removed or treated until that risk level is attained.

3. Remove hazard tree targets. Under this alternative, campgrounds or selected areas within campgrounds that are identified as targets are closed to public use. Removal of potential targets will remove the problem of hazard trees.

4. Develop a vegetation management plan based on objectives developed for the site, which reduces incidence of insect and disease and development of hazard trees. This may include activities such as: Thinning dense stands of trees to reduce stress and the probability of bark beetle attack; sanitizing to decrease the incidence of DM-infection (for example, the foreground retention area at Cedar Creek CG); pruning DM-infected trees to prolong their life span near campsites and permanent structures; and underplanting the infected ponderosa pine overstory of recreation sites with habitat compatible nonhost species such as southwestern white pine and Douglas-fir; removing stumps with armillaria infections, especially in South Fork CG.

5. A combination of alternatives 2, 3, and 4. These alternatives are not mutually exclusive and can be used in combination to solve specific problems in many areas.

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APPENDIX

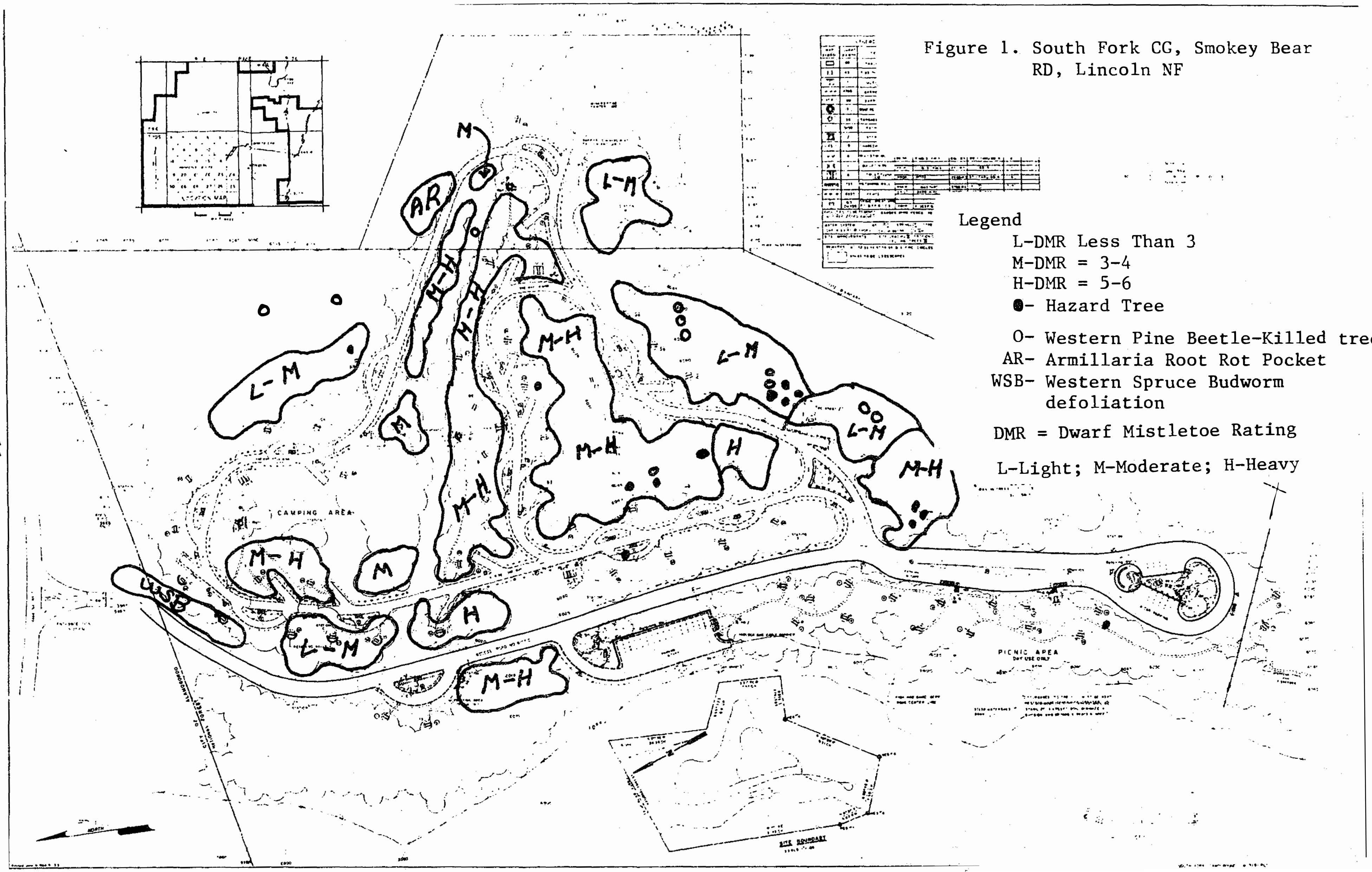


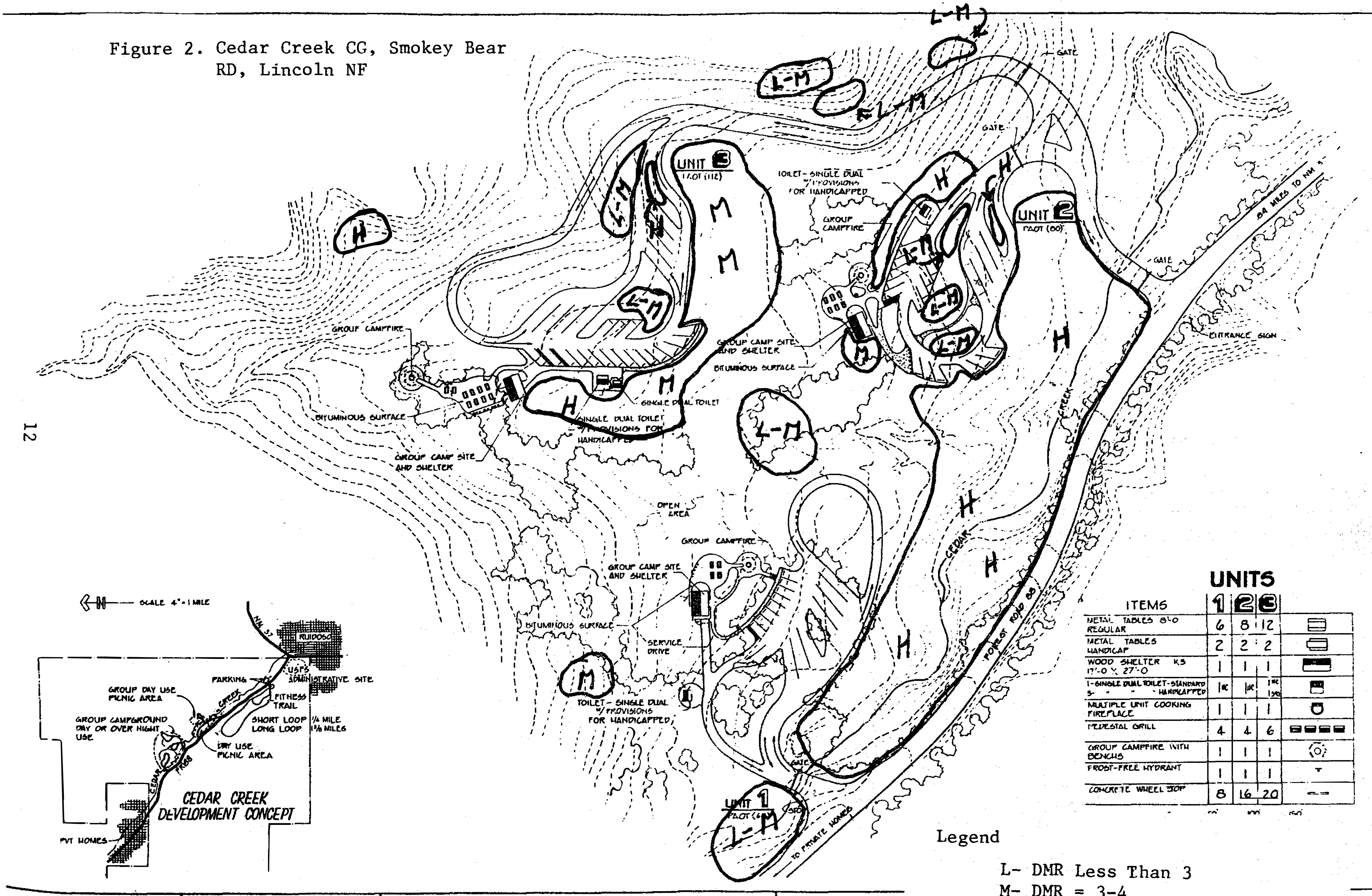
Figure 1. South Fork CG, Smokey Bear RD, Lincoln NF

Legend
- L-DMR Less Than 3
- M-DMR = 3-4
- H-DMR = 5-6
- ●- Hazard Tree
- O- Western Pine Beetle-Killed tree
- AR- Armillaria Root Rot Pocket
- WSB- Western Spruce Budworm defoliation

DMR = Dwarf Mistletoe Rating

L-Light; M-Moderate; H-Heavy

Figure 2. Cedar Creek CG, Smokey Bear RD, Lincoln NF



ITEMS	1	2	3
METAL TABLES 8'-0 REGULAR	6	8	12
METAL TABLES HANDICAP	2	2	2
WOOD SHELTER KS 17'-0 X 27'-0	1	1	1
1-SINGLE DUAL TOILET-STANDARD / " " " -HANDICAPPED	1sc	1sc	1sc 1sd
MULTIPLE UNIT COOKING FIREPLACE	1	1	1
PEDESTAL GRILL	4	4	6
GROUP CAMPFIRE WITH BENCHS	1	1	1
FROST-FREE HYDRANT	1	1	1
CONCRETE WHEEL STOP	8	16	20

Legend

L- DMR Less Than 3
M- DMR = 3-4
H- DMR = 5-6

DMR = Dwarf Mistletoe Rat
L-Light; M-Moderate; H-Heavy

TREE HAZARD EVALUATION

Administrative unit Smokey Bear RD

Site name South Fork Campground

Examined by ______

Date 3/15/90

Campground or Picnic Unit No.	Tree Location (azimuth and distance from fixed object) — ABBREVIATIONS: TO=Toilet, TB=Table, FR=Fire ring, PP=Parking pad, TP=Tent pad, WH=Water hydrant, BG=Bridge, TC=Trash can, TD=Trailer dump	Species	D.b.h.	*See Abbreviations Type of defect: Leaning (angle of lean)	Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Medium	Low	Risk rating: High	Medium	Low	Additional comments — *DEFECT ABBREVIATIONS: RR=Root rot, BR=Bole or butt rot, BW=Bole wound, BC=Basal cavity, LD=Limb defect, WF=Weak Fork, C=Conk(s), DT=Dead top, ER=Exposed roots	Action
16	TB 9' 260°	PP	26				X	X			X			X			LD (Dead limbs)	
	from info sign ≈120' 170°	PP	19				X										Dead	
	" "	PP	11				X										Dead	
	" "	PP	5				X			X	X					X	Dead	
19	TB ≈120' 155°	PP	18				X	X			X					X	Dead	
19	" " "	PP	12				X	X			X					X	Dead	
19	PP 63' 115°	PP	11				X	X			X			X			Dead	
Road	PP 75' 90°	PP	20					X			X					X	Dead	
18	TB 57' 245°	PP	28					X			X			X			Dead	

TREE HAZARD EVALUATION

Administrative unit Smokey Bear RD

Examined by

Site name South Fork Campground

Date 3/15/90

Campground or Picnic Unit No.	Tree Location (azimuth and distance from fixed object) ABBREVIATIONS: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.b.h.	*See Abbreviations Type of defect: Leaning (angle of lean)	Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Medium	Low	Risk rating: High	Medium	Low	Additional comments *DEFECT ABBREVIATIONS: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak Fork C=Conk(s) DT=Dead top ER=Exposed roots	Action
29	PP 17' 205°	PP	14				X	X			X			X			Dead	
38	TB 30' 95°	PP	12				X	X			X			X			Dead	
38	TB 60' 115°	PP	12				X	X			X					X	Dead	
36	TB 33' 115°	PP	16				X	X			X			X			Dead	
46	TB 90' 30°	PP	20				X	X			X			X				